

possibility of such a transmission, Prof. Vines should interpret that in my favour, not to my discredit; it is not the business of an investigator to set forth a proposition, which on the existing evidence he is compelled to believe, as an infallible dogma. Prof. Vines finds my "statements of opinion so fluctuating that it is difficult to determine what [my] position exactly is," but he could have easily discovered my meaning, if, instead of promiscuously contrasting the eight essays and the eight years of their production, he had merely brought the last of them to the bar of judgment. This essay is especially concerned with "the supposed transmission of mutilations," and at its conclusion my verdict on the state of the problem of the inheritance of acquired characters is thus summarised:—"The true decision as to the Lamarckian principle [lies in] the explanation of the observed phenomena of transformation. . . . If, as I believe, these phenomena can be explained without the Lamarckian principle, we have no right to assume a form of transmission of which we cannot prove the existence. Only if it could be shown that we cannot now or ever dispense with the principle, should we be justified in accepting it." The distinguished botanist De Vries has proved that certain constituents of the cell-body, e.g. the chromatophores of *Algæ*, pass directly from the maternal ovum to the daughter-organism, while the male germ-cell generally contains no chromatophores. Here it appears possible that a transmission of somatogenic variation has occurred; in these lower plants, the separation between somatic and reproductive cells is slight, and the body of the ovum does not require a complete chemical and physical alteration to become the body of the somatic cell of the daughter. But how does this affect the question whether, for instance, a pianoforte player can transmit to his progeny that strength of his finger-muscles which he has acquired by practice? How does this result of practice arrive at the germ-cells? In that lies the real problem which those have to solve who maintain that somatogenic characters are transmissible.

It is proved by the observations of Boveri, quoted above, that among animals the body of the ovum contributes nothing to inheritance. If the transmission of acquired characters should take place, it would have to be by means of the nuclear matter of the germ-cells—in fact, by the germ-plasm, and that not in its patent, but in its latent condition.

To renounce the principle of Lamarck is certainly not the way to facilitate the explanation of the phenomena; but we require, not a mere formal explanation of the origin of species of the most comfortable nature, but the real and rightful explanation. We must attempt, therefore, to elucidate the phenomena without the aid of this principle, and I believe myself to have made a beginning in this direction. A short time ago I tried this in one of those cases where one would least expect to be able to dispense with the principle of modification by use—namely, in the question of artistic endowment.¹ I proposed to myself the question whether the musical sense of mankind could be conceived of as arising without a heightening of the original acoustic faculty by use. But even here I came to the conclusion that, not only do we not need this principle, but that use has actually taken no part in the development of the musical sense.

A. WEISMANN.

THE LIFE AND WORK OF G. A. HIRN.

THE three men who worked at the experimental determination of the mechanical equivalent of heat and at practical Thermodynamics have passed away within a few months of each other—Clausius, Joule, and now Hirn.

¹ "Gedanken über Musik bei Thieren und bei Menschen," *Deutsche Rundschau*, October 1889.

They were much of the same age, and began their experiments while young at almost the same time; and the practical agreement of the conclusions drawn from their experimental results is our best guarantee of confidence in the modern theory of Thermodynamics which is built upon these results.

Gustave Adolphe Hirn was born at Logelbach, in Alsace, on August 21, 1815, and died on January 14 of this year, a victim to the prevailing epidemic of influenza; but for this, we might have expected still further developments of his scientific theories, as he continued at work on his favourite subjects to the last.

Self-taught, so far as his scientific education was concerned, he found himself, with his elder brother Ferdinand, a manager of the works of Haussman, Jordan, and Co., an establishment for the fabrication of *indiennes*, established in 1772. Finding the machinery antiquated and worn out, Hirn, in setting to work to make the best of it, was really better placed for theorizing and experimentalizing than if he had charge of modern works in first-rate order. The different parts of the works being at a distance from each other, his brother Ferdinand brought out his system of cable transmission of power; and it was Gustave who pointed out theoretically the advantage of a thin light cable run at a high speed.

Hirn also turned his attention to the important economic question of the lubrication of machinery, and upset the previous prejudice against the use of mineral oil for this purpose. He also demonstrated experimentally that, while the old laws of friction enunciated by Morin were sufficiently accurate for the contact of one dry metal against another, these laws are powerfully modified when the surfaces are well lubricated, as with machinery. Now the friction varies as the square root of the pressure, and as the surface and the velocity; so that the theory falls in with that of the viscous flow of liquids. These laws have received confirmation of recent years by the experiments carried out under the auspices of the Institution of Mechanical Engineers.

But it is chiefly for his experiments on a large scale on the steam-engines under his charge that Hirn is best known, and from his varied methods of determining the mechanical equivalent of heat by the friction of metals on metal or water, and finally from observation of the amount of heat consumed by the steam-engine, when every source of gain or loss is carefully followed up.

With this object he investigated experimentally the separate effects of conduction, of jacketing, of initial condensation in the cylinder, and of its prevention by superheating.

If we watch the performance of a modern marine triple-expansion engine, we notice that the high-pressure cylinder appears choked with water from initial condensation, while the intermediate and low-pressure cylinders work comparatively dry. It was considered in the early days of compound engines that this initial condensation was a source of great loss, and superheating was introduced to minimize it. But the superheated steam ruined the packings, and dried up the lubricant, so that the superheater was found practically to do more harm than good. A characteristic story is told of John Elder, the pioneer of compounding in modern marine engines, too long to insert here, which bears on this point.

Nowadays this initial condensation is looked upon as inevitable, and as not really so uneconomical as the books make out, when attendant advantages are considered; but to the theorist such as Hirn this condensation was something to be avoided at any cost, and he worked hard to make its prevention feasible.

Hirn was a man of varied reading, taste, and pursuits, and he worked into his treatises on his favourite subject of Thermodynamics a good deal of speculative metaphysics, which make his books rather curious reading sometimes to modern tastes, and we must go back to the

time of Descartes and Leibnitz, when physical science and moral philosophy went hand in hand, to find an equivalent.

But it must be allowed that the science of Thermodynamics may be treated with advantage from this double point of view; for, after its First Law has been established, that heat and work are equivalent and interchangeable, the rate of exchange being fixed by the mechanical equivalent of Joule and Hirn, when we come to the Second Law, named after Carnot, we are compelled to secure conviction of its truth by an appeal to the arguments of analogy and metaphysics.

Hirn spent the last years of his life at Colmar, in the society of a few congenial friends, much interested in metaphysics and meteorology, but cut off from his native France by international strained relations.

In this age of practical Thermodynamics his work will not be lost sight of; but we are still far from a complete reconciliation of the abstract theories of the books and the observed realities of practice.

A. G. GREENHILL.

NOTES.

THE Croonian Lecture, which will be delivered before the Royal Society on February 27 by Prof. Marshall Ward, will be on "The Relations between Host and Parasite in certain Epidemic Diseases of Plants."

ON Thursday last the Astronomer-Royal was elected by ballot to fill the place of the late Father Perry upon the Council of the Royal Society.

METEOROLOGISTS will be sorry to hear of the death of Prof. C. H. D. Buys-Ballot, on Sunday last. He was born in 1817, and had been Director of the Meteorological Institute, Utrecht, for more than 30 years.

DR. DAVID SHARP, the eminent entomologist, and late President of the Entomological Society of London, has accepted the appointment of Curator in Zoology in the Museum of the University of Cambridge, rendered vacant by the resignation of the Rev. A. H. Cooke, whose labours on the Macandrew Collection in that Museum have been so highly appreciated by conchologists.

SIR WILLIAM GULL, F.R.S., was so distinguished a physician, and his name was so well known, that the tidings of his death excited a widespread feeling of regret. He died on Wednesday, January 29, from paralysis, and the funeral took place on Monday at the churchyard of Thorpe-le-Soken, Essex. He was in his seventy-fifth year.

WE regret to hear of the death of Dr. L. Taczanowski, which took place at Warsaw on January 11. He is best known for his standard work "Ornithologie du Pérou," but his contributions to the ornithology of Poland, of Siberia, and the Corea have also been numerous and important.

GERMAN papers announce the death of Otto Rosenberger, the well-known astronomer. He was born in Courland in 1810, and in 1831 was appointed to the charge of the Observatory at Halle, and at the same time was made Professor of Mathematics. This position he held during the rest of his long life. Rosenberger's name is known chiefly in association with his work relating to Halley's comet.

ANOTHER death which we are sorry to have to record is that of Prof. Neumayr, the geologist, of Vienna. He was only a little over forty years of age, and his death is a great loss.

ON February 15, Lord Rayleigh will begin a course of seven lectures at the Royal Institution. The subject will be electricity and magnetism.

THE Council of the Society of Arts have arranged that a course of lectures on "The Atmosphere" shall be given by Prof. V. Lewes on the following Saturday afternoons: March 8, 15, 22, and 29, at 3 o'clock.

MR. B. A. GOULD, Cambridge, Mass., has been appointed President of the American Metrological Society for the present year. Among the members of the Council of this Society are Messrs. Cleveland Abbe, H. A. Newton, Simon Newcomb, and S. P. Langley. The Society was founded in 1873, and its objects are to improve existing systems of weights, measures, and moneys, and to bring them into relations of simple commensurability with each other; to secure the universal adoption of common units of measure for quantities in physical observation or investigation, for which ordinary systems of metrology do not provide; to secure uniform usage as to standard points of reference, or physical conditions to which observations must be reduced for purposes of comparison; and to secure the use of the decimal system for denominations of weight, measure, and money derived from unit-bases, not necessarily excluding for practical purposes binary or other convenient divisions.

THE Committee of the Cambridge University Antiquarian Society in their fifth Annual Report state that, since the opening of the Archæological Museum in 1884, over 2800 objects and 900 books have been added to the collection. The most important additions have been made in the ethnological department, including (during the past year) General Scratchley's collections from New Guinea, a series of 500 specimens of implements and ornaments from the West Indies, presented by Colonel Fielden, who has also given many rare stone implements and weapons collected in South Africa, and a series of 70 specimens of dresses, weapons, &c., from the Solomon and Banks Islands and from Santa Cruz, presented by Bishop Selwyn. The Curator, Baron von Hügel, reports that during the long vacation he excavated with success a Roman refuse-pit and a burial-place at the eastern side of Alderney. The digging is to be resumed.

THE seventh annual dinner of the Association of Public Sanitary Inspectors was held on Saturday evening at the First Avenue Hotel, Holborn. Dr. B. W. Richardson presided, and proposed the toast of "The Association and its President, Sir Edwin Chadwick." The duties of the Association, he said, were to teach and protect its members, and all sanitary inspectors ought to belong to it. He hoped that the apathy at present shown by too many of them would not last any longer.

DR. A. N. BERLESE, of Padua, has been appointed Professor of Botany to the Royal Lyceum at Ascoli-Piceno; and Dr. J. H. Wakker, of Utrecht, Professor of Botany at the dairy school at Oudshoorn, Holland.

THE *Botanical Gazette* published at Crawfordsville, Indiana, gives some particulars of one of the most magnificent bequests ever made for scientific purposes, that of the late Mr. H. Shaw for the endowment of the Botanic Garden and School of Botany at St. Louis, Missouri, amounting to not less than between three and five million dollars. The trustees have determined to apply the income to the maintenance and increase in the scientific usefulness of the Botanic Garden; to provide fire-proof quarters for the invaluable herbarium of the late Dr. George Engelmann, and to supply means for its enlargement; to secure a botanical museum; and to gradually acquire and utilize facilities for research in vegetable physiology and histology, the diseases and injuries of plants, and other branches of botany and horticulture. To aid in the carrying out of this last purpose, travelling botanical scholarships have been established. The present very able director of the Botanic Garden is Dr. William Trelease.